



Range extension and first record of *Coendou speratus* Mendes Pontes et al., 2013 (Rodentia, Erethizontidae) from a cloud forest enclave in northeastern Brazil

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Abstract

We present the first record of *Coendou speratus* from a cloud forest enclave, based on an adult male specimen captured in April 2016 in a house in the urban zone of the municipality of Garanhuns, in the state of Pernambuco, northeastern Brazil. This record extends the known geographic distribution of the species 167 km west of the type locality in the Atlantic Forest biome. This record is now the westernmost limit of the geographic distribution of this species.

Key words

Erethizontidae; geographical range; Mammalia; Porcupine; Rodentia.

Academic editor: Alexandra Maria Ramos Bezerra | Received 4 February 2017 | Accepted 2 September 2017 | Published 15 December 2017

Citation: Leal ESB, Gomes-Silva FF, Lyra-Neves RM, Telino-Júnior WR (2017) Range extension and first record of *Coendou speratus* Mendes Pontes et al., 2013 (Rodentia, Erethizontidae) from a cloud forest enclave in northeastern Brazil. Check List 13 (6): 951–957. <https://doi.org/10.15560/13.6.951>

Introduction

In Brazil, the genus *Coendou* Lacépède, 1799 (Rodentia, Erethizontidae), here including *Sphiggurus* Cuvier, 1825, is represented by 8 species (Voss 2011, Paglia et al. 2012, Mendes-Pontes et al. 2013, Feijó and Langguth 2013). These Neotropical prehensile-tailed porcupines are found in all terrestrial biomes in Brazil except the Pampas grasslands (Voss 2011, Paglia et al. 2012, Mendes-Pontes et al. 2013, Feijó and Langguth 2013). Two species are known to occur in the Atlantic Forest of northeastern Brazil, *Coendou prehensilis* (Linnaeus, 1758), which is found in

the states of Paraíba, Pernambuco and Alagoas (Feijó and Langguth 2013, Leite et al. 2011), and *Coendou speratus* Mendes Pontes et al., 2013, a recently-described species, which is restricted to a few forest fragments in Alagoas and Pernambuco states (Feijó and Langguth 2013, Mendes Pontes et al. 2013, Nascimento and Santos 2014) (Fig. 1).

Coendou speratus, known locally in northeastern Brazil as the “coandu-mirim”, has been recorded at several locations in Pernambuco state, including Mata do Tauá, Boca da Mata, Mata do Xanguazinho, and Mata da Barra-gem on the Usina Trapiche sugar plantation, located at 85

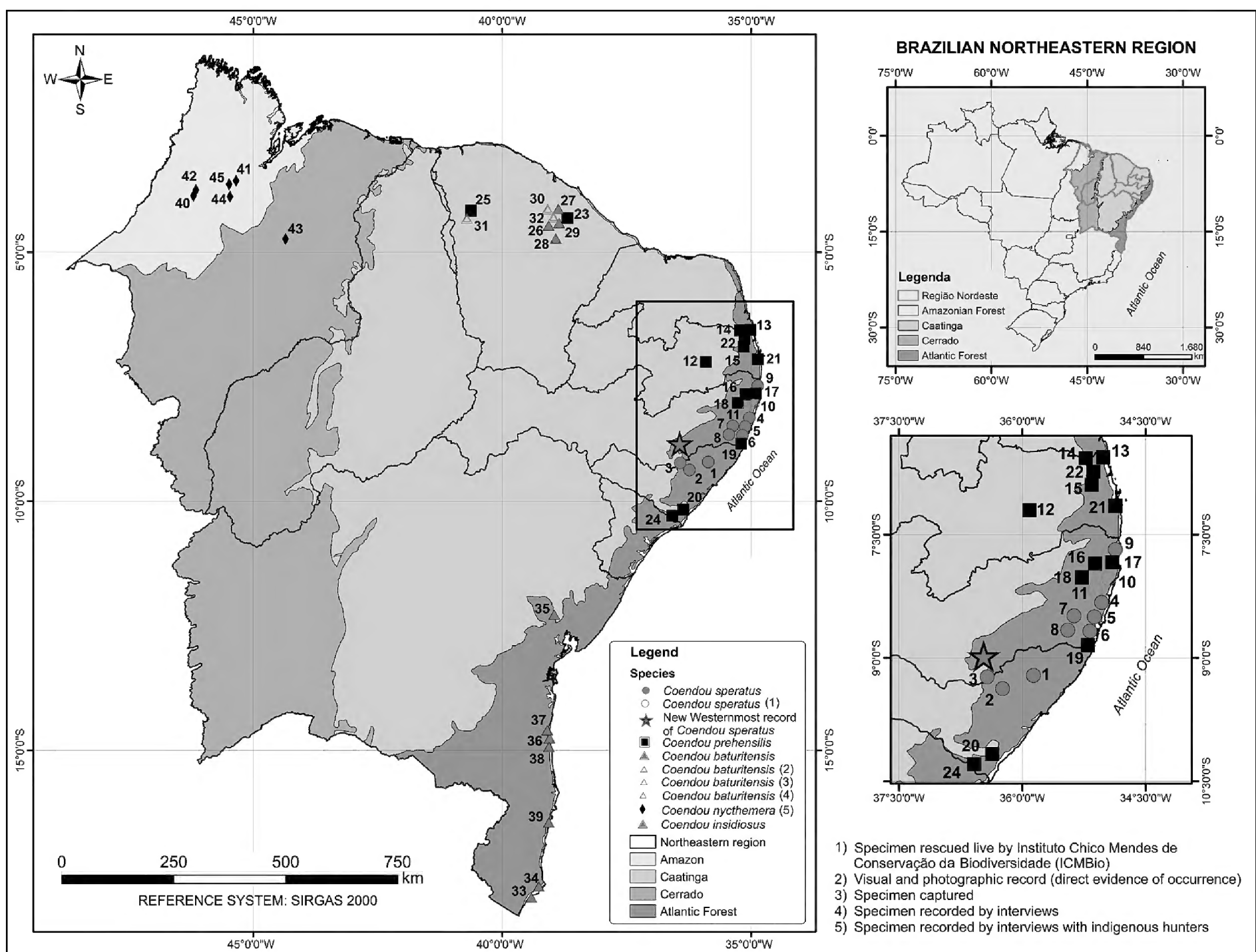


Figure 1. Localities of *Coendou speratus* (red circle), *Coendou prehensilis* (square black), *Coendou baturitensis* (blue triangle), *C. insidiosus* (yellow triangle), and *C. nycthemera* (black diamond) in northeastern Brazil. According to the IBGE biome shapefile, the new occurrence is still part of the Atlantic Forest biome. See also Table 1.

m above sea level, in the municipality of Sirinhaém, and in the Charles Darwin Ecological Refuge in the municipality of Igarassu (Mendes Pontes et al. 2013, Feijó and Langguth 2013).

The Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) has also recorded the rescue of live specimens in the municipalities of Jaboatão dos Guararapes and Recife, both in Pernambuco state. The specimen rescued in Guararapes was released into the Brennand protected forest within the urban zone of Recife, while the other individual was released into the Xanguá forest on the Trapiche Sugar Plantation in Sirinhaém (Feijó and Langguth 2013, Mendes Pontes et al. 2013). In Alagoas state, *C. speratus* has been recorded in the municipality of Viçosa and in the Murici Ecological Station in the municipality of Murici (Mendes Pontes et al. 2013, Feijó and Langguth 2013, Nascimento and Santos 2014).

In Pernambuco state, *C. speratus* may occur in sympatry with the larger *C. prehensilis* (Mendes Pontes et al. 2013, Feijó and Langguth 2013) (Fig. 1, Table 1), but is easily distinguished by its smaller size, the conspicuous brownish red tips of the dorsal quills, which contrast with the blackish background color, and the dorsal profile of the rectilinear type skull, which is not vaulted in the anterior region (Feijó and Langguth 2013).

Mendes Pontes et al. (2013) commented that *C. speratus* is broadly similar to *Coendou nycthemera* (Olfers, 1818), another erethizontid species that occurs in northeastern Brazil, but can be distinguished from this congener by the fact that, whereas the dorsal quills of *C. nycthemera* are typically bicolored (white base, black tip), those of *C. speratus* are tricolored (yellow base, black middle, brownish red tip), even though most *C. nycthemera* specimens have at least some tricolored (white- or pale-brown-tipped) quills. In *C. nycthemera*, the general appearance is black speckled with white or pale brown, whereas in *C. speratus*, it is brownish red in color (Mendes Pontes et al. 2013). In *C. nycthemera*, the tail is mostly covered with short black hairs, whereas in *C. speratus*, it is covered with brown to reddish bristles (Mendes Pontes et al. 2013).

Coendou speratus has already been classified as endangered with extinction by the Brazilian authorities (MMA 2014) due to its very restricted distribution and highly fragmented and declining populations in the Atlantic Forest of the Pernambuco Center of Endemism, although the species has yet to be evaluated by the International Union for Conservation of Nature (Mendes Pontes et al. 2016). In this paper, we provide the first record of *C. speratus* in a cloud forest enclave within the Caatinga dry forest biome, and extend the known distribution of the species 167 km west of its type locality.

Table 1. Recording localities for *Coendou* species (Rodentia: Erethizontidae) in northeastern Brazil. Code numbers refer to the localities shown in Figure 1.

Species	State	Municipality	Locality	Environment	Symbol	Source
<i>C. speratus</i>	Alagoas	Murici	Estação Ecológica de Murici*	Atlantic Forest	Red Circle 1	Silva & Nascimento 2014
<i>C. speratus</i>	Alagoas	Viçosa	Around Viçosa*	Atlantic Forest	Red Circle 2	Feijó & Langguth 2013; Silva & Nascimento 2014
<i>C. speratus</i>	Pernambuco/ Alagoas	South Pernambuco/ North Alagoas	Reserva Biológica Pedra Talhada*	Atlantic Forest	Red Circle 3	Langguth & Guerra 2015
<i>C. speratus</i>	Pernambuco	Sirinhaém	Usina Trapiche sugar plantation, Boca da Mata*	Atlantic Forest	Red Circle 4	Mendes Pontes et al. 2013; Feijó & Langguth 2013
<i>C. speratus</i>	Pernambuco	Sirinhaém	Usina Trapiche sugar plantation, Mata da Barragem*	Atlantic Forest	Red Circle 5	Mendes Pontes et al. 2013; Feijó & Langguth 2013
<i>C. speratus</i>	Pernambuco	Sirinhaém	Usina Trapiche sugar plantation, Mata do Tauá*	Atlantic Forest	Red Circle 6	Mendes Pontes et al. 2013; Feijó & Langguth 2013
<i>C. speratus</i>	Pernambuco	Sirinhaém	Usina Trapiche sugar plantation, Mata do Xanguá (Type Locality) *	Atlantic Forest	Red Circle 7	Mendes Pontes et al. 2013
<i>C. speratus</i>	Pernambuco	Sirinhaém	Usina Trapiche sugar plantation, Mata do Xanguazinho*	Atlantic Forest	Red Circle 8	Mendes Pontes et al. 2013
<i>C. speratus</i>	Pernambuco	Igarassú	Refúgio Ecológico Charles Darwin*	Atlantic Forest	Red Circle 9	Feijó & Langguth 2013
<i>C. speratus</i>	Pernambuco	Garanhuns	In a house located at 551 Restauração Pernambucana Street, in the Boa Vista neighborhood*	Cloud Forest	Green Star	Present Study
<i>C. speratus</i>	Pernambuco	Jaboatão dos Guararapes	Forest fragment in Curado IV ⁽¹⁾	Atlantic Forest	Red Circle 10	Mendes Pontes et al. 2013
<i>C. speratus</i>	Pernambuco	Recife	Várzea ⁽¹⁾	Atlantic Forest	Red Circle 11	Mendes Pontes et al. 2013
<i>C. prehensilis</i>	Paraíba	João Pessoa	Campus Universitário I, UFPB*	Atlantic Forest	Black Square 12	Feijó & Langguth 2013
<i>C. prehensilis</i>	Paraíba	Mataraca	Mineradora Millenium Inorganic Chemicals*	Atlantic Forest	Black Square 13	Feijó & Langguth 2013
<i>C. prehensilis</i>	Paraíba	Mataraca	Uruba*	Atlantic Forest	Black Square 14	Feijó & Langguth 2013
<i>C. prehensilis</i>	Paraíba	Mamanguape	Reserva Biológica Guaribas*	Atlantic Forest	Black Square 15	Feijó & Langguth 2013
<i>C. prehensilis</i>	Pernambuco	Camaragibe	Residencial Canaã Estrada de Aldeia (PE 027), 7 km, Aldeia*	Atlantic Forest	Black Square 16	Feijó & Langguth 2013
<i>C. prehensilis</i>	Pernambuco	Igarassú	Cruz de Rebouças, Estrada do Cajá*	Atlantic Forest	Black Square 17	Feijó & Langguth 2013
<i>C. prehensilis</i>	Pernambuco	Recife	Parque Estadual Dois Irmãos (PEDI) *	Atlantic Forest	Black Square 18	Monteiro da Cruz & Barreto-Campello 1998
<i>C. prehensilis</i>	Pernambuco	Sirinhaém	Usina Trapiche sugar plantation, Mata do Xanguá (Type Locality) *	Atlantic Forest	Black Square 19	Leite et al. 2011; Mendes Pontes et al. 2013
<i>C. prehensilis</i>	Alagoas	Manimbu	Around Manimbu*	Atlantic Forest	Black Square 20	Feijó & Langguth 2013
<i>C. prehensilis</i>	Paraíba	João Pessoa	Mata do Buraquinho*	Atlantic Forest	Black Square 21	Percequillo et al. 2007
<i>C. prehensilis</i>	Paraíba	Mamanguape/Rio Tinto	Reserva Biológica Guaribas and vicinity*	Atlantic Forest	Black Square 22	Feijó et al. 2016
<i>C. prehensilis</i>	Ceará	Baturité	Around Baturité	Caatinga	Black Square 23	Oliveira et al. 2003
<i>C. prehensilis</i>	Alagoas	Penedo	Around Penedo	Caatinga	Black Square 24	Oliveira et al. 2003
<i>C. prehensilis</i>	Ceará	Ipú	Around Ipú	Caatinga	Black Square 25	Oliveira et al. 2003
<i>C. baturitensis</i>	Ceará	Aratuba	Serra do Baturité, Comunidade Barreiros (Type Locality)	Baturité Ridge	Blue Triangle 26	Feijó & Langguth 2013
<i>C. baturitensis</i>	Ceará	São Benedito	Sítio Cinta da Soledade*	Baturité Ridge	Blue Triangle 27	Feijó & Langguth 2013
<i>C. baturitensis</i>	Ceará	Pacoti	Sítio Ouro*	Baturité Ridge	Blue Triangle 28	Feijó & Langguth 2013
<i>C. baturitensis</i>	Ceará	Baturité	Serra do Baturité*	Baturité Ridge	Blue Triangle 29	Freitas 1957; Feijó & Langguth 2013
<i>C. baturitensis</i>	Ceará	Mulungu	Around Mulungu ⁽²⁾	Baturité Ridge	Blue Triangle 30	Fernandes-Ferreira et al. 2015
<i>C. baturitensis</i>	Ceará	Ipú	Around Ipú ⁽³⁾	Baturité Ridge	Blue Triangle 31	Freitas 1957; Feijó & Langguth 2013
<i>C. baturitensis</i>	Ceará	Guaramiranga	Serra do Baturité ⁽⁴⁾	Baturité Ridge	Blue Triangle 32	Feijó & Langguth 2013
<i>C. insidiosus</i>	Bahia	Nova Viçosa	Fazenda Elma*	Caatinga	Yellow Triangle 33	Caldara Júnior & Leite 2012; Mendes Pontes et al. 2013
<i>C. insidiosus</i>	Bahia	Caravelas	Fazenda Monte Castelo*	Caatinga	Yellow Triangle 34	Caldara Júnior & Leite 2012; Mendes Pontes et al. 2013
<i>C. insidiosus</i>	Bahia	Feira de Santana	Around Feira de Santana*	Caatinga	Yellow Triangle 35	Caldara Júnior & Leite 2012

Continued

Table 1. Continued.

Species	State	Municipality	Locality	Environment	Symbol	Source
<i>C. insidiosus</i>	Bahia	Ilhéus	Fazenda Ibaíti, Banco da Vitória*	Caatinga	Yellow Triangle 36	Caldara Júnior & Leite 2012
<i>C. insidiosus</i>	Bahia	Ilhéus	Fazenda Pirataquissé, Banco da Vitória*	Caatinga	Yellow Triangle 37	Caldara Júnior & Leite 2012; Mendes Pontes et al. 2013
<i>C. insidiosus</i>	Bahia	Ilhéus	Around Ilhéus*	Caatinga	Yellow Triangle 38	Caldara Júnior & Leite 2012
<i>C. insidiosus</i>	Bahia	Porto Seguro	Around Porto Seguro*	Caatinga	Yellow Triangle 39	Caldara Júnior & Leite 2012; Mendes Pontes et al. 2013
<i>C. nycthemera</i>	Maranhão	-	Posto Indígena Tiracambu ⁽⁵⁾	Amazon	Black Diamond 40	Oliveira et al. 2007
<i>C. nycthemera</i>	Maranhão	-	Pindaré ⁽⁵⁾	Amazon	Black Diamond 41	Oliveira et al. 2007
<i>C. nycthemera</i>	Maranhão	-	Posto Indígena Awa ⁽⁵⁾	Amazon	Black Diamond 42	Oliveira et al. 2007
<i>C. nycthemera</i>	Maranhão	Bom Jardim	Around Bom Jardim ⁽⁵⁾	Amazon	Black Diamond 43	Oliveira et al. 2007
<i>C. nycthemera</i>	Maranhão	Santa Luzia	Around Santa Luzia ⁽⁵⁾	Amazon	Black Diamond 44	Oliveira et al. 2007
<i>C. nycthemera</i>	Maranhão	Bom Jardim	Posto Indígena Pindaré ⁽⁵⁾	Amazon	Black Diamond 45	Oliveira et al. 2007

(*) Vouchers deposited in scientific collection, (1) specimen rescued live by Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), (2) visual and photographic records (direct evidence of occurrence), (3) specimen captured, (4) specimen recorded by interviews, and (5) specimen recorded by interviews with indigenous hunters.

Methods

At 19:00h on 27 April 2016, an adult *Coendou speratus* (Fig. 2) was recovered from a house in Garanhuns, by firefighters of the Pernambuco State Fire Department (1st detachment, 6th Group). The house is located at 551 Restauração Pernambucana Street, in the Boa Vista neighborhood (08°54'8.7" S, 036°29'29.0" W) of Garanhuns, Pernambuco, near the João da Mata school, within the urban zone (Fig. 3). Following data collection, the specimen was released into a protected area of the Fazenda Mata do Mel. This property, which includes 40 ha of preserved forest, is located in the municipality of Brejão, which is contiguous with Garanhuns.

The municipality of Garanhuns (472 km²) is located on the Borborema Plateau in the southern Agreste zone of Pernambuco, with a mean altitude of 896 m, 225 km west of the state capital, Recife (Andrade et al. 2008). The climate is temperate mediterranean mesothermic (Koppen's Csa), with a mean temperature of 20 °C, mean annual precipitation of 1333 mm, and relative humidity of 75–83% (Andrade et al. 2008). Most of the municipality, including the entire urban zone, is located within a cloud forest enclave. While being located within the semiarid Caatinga, these enclaves of semi-deciduous montane forest are considered part of the Atlantic Forest (Velooso et al. 1981, Andrade-Lima 1982).

Characterized by evergreen or sub-perennial forest cover on mountaintops and adjacent slopes surrounded by xerophytic Caatinga vegetation at the lower altitudes (Andrade-Lima 1960, Locatelli et al. 2004), these ecosystems are found at altitudes over 600 m. The climate is humid or sub-humid, with annual precipitation of between 900 and 1300 mm, and the soils are deep and loamy, with high levels of available water, and a predominance of red-yellow podzolic soils and humic yellow-red latosols (Jatobá 1989).

Results

The specimen collected in Garanhuns presents the tricolored dorsal quills from the head to the midbody (yellow at the base, black in the middle and reddish or orange at the tips), and patches of shorter bicolored quills, yellowish long base and black tip (Figs 2, 4). The dorsal quills, which prove the record and may be used in future taxonomic studies, were deposited in the mammal collection of the Federal University of Pernambuco, Recife, Brazil, with the number UFPE 3454. The dorsal quills collected in Garanhuns presents the diagnostic traits of *C. speratus* described by Mendes Pontes et al. (2013) and Feijó and Langguth (2013).

Discussion

The new record from Garanhuns of *C. speratus* extends the geographic range of this species west of the type locality in the Atlantic Forest ecoregion and represents



Figure 2. *Coendou speratus* recorded in the municipality of Garanhuns, Pernambuco, Brazil (photograph by Wallace R. Telino-Júnior).

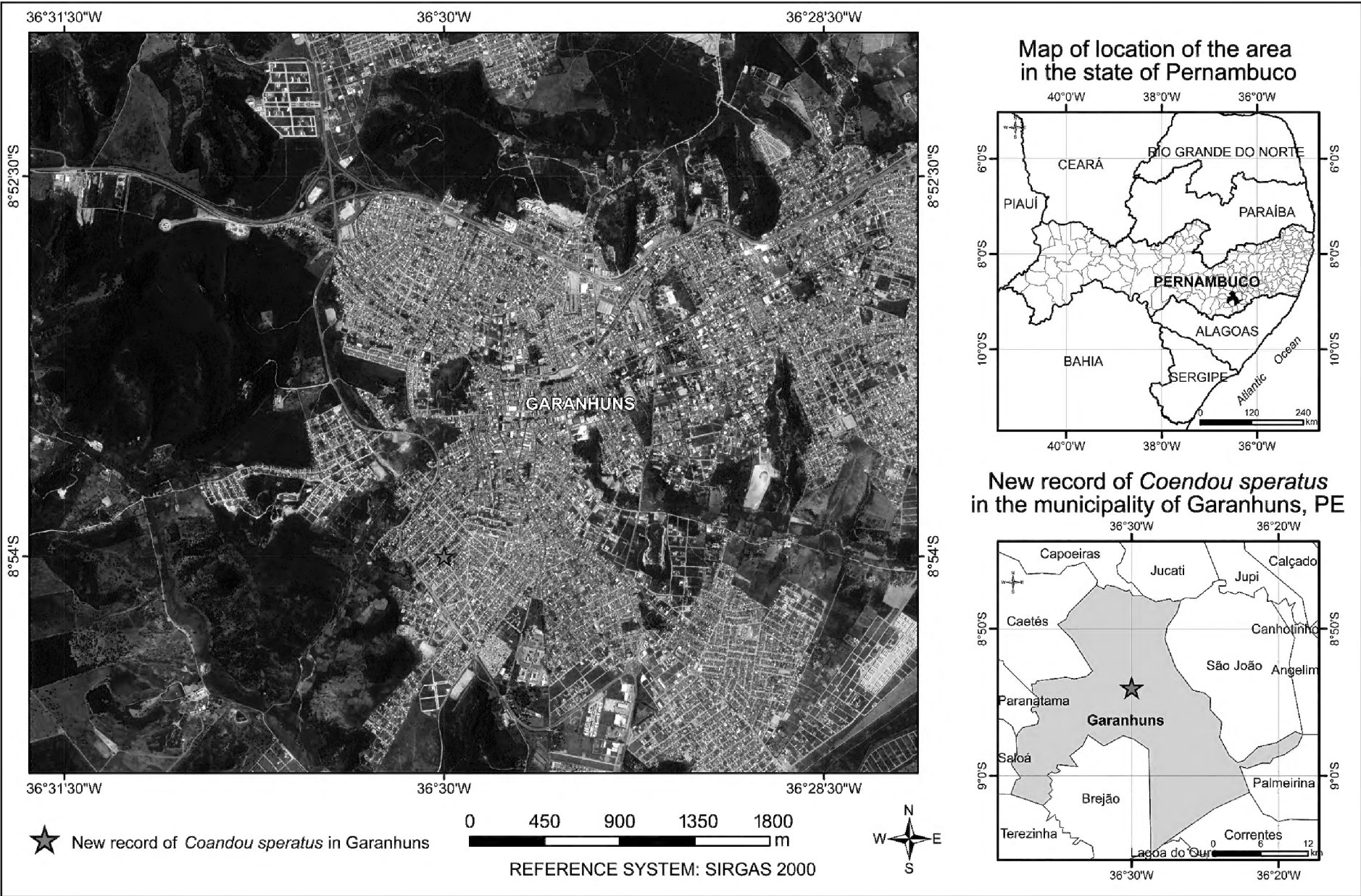


Figure 3. New record of *Coendou speratus* in the municipality of Garanhuns, Pernambuco, Brazil.

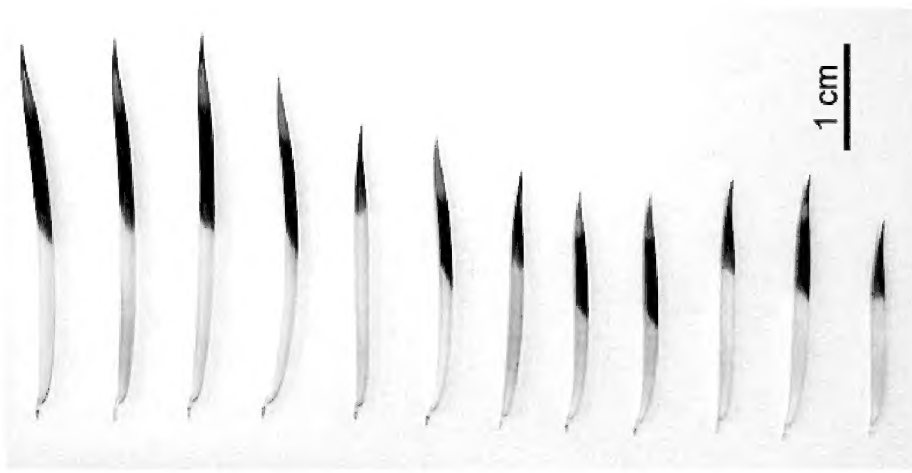


Figure 4. Dorsal quills of *Coendou speratus* (UFPE 3454) recorded in Garanhuns, Pernambuco, Brazil. Tricolored and bicolored quills. Scale bars = 1 mm. (Photograph by Wallace R. Telino-Júnior.)

the western limit of the distribution of this species. The record provides important new data on *C. speratus*, which previously was assumed be endemic to the Pernambuco Center of Endemism (Mendes Pontes et al. 2013, Feijó and Langguth 2013, Nascimento and Santos 2014). While the specimen described here was captured in an urban environment, the town of Garanhuns is surrounded by mountains covered with natural vegetation, which are likely the origin of the animal captured. The appearance of the animal in the urban zone may reflect habitat disturbance in its natural range or may have resulted from other processes, such as migration or foraging behavior. Another hypothesis is that local people may have brought the specimen to the town.

In northeastern Brazil, cloud forest formations are found in the states of Pernambuco, Paraíba, Rio Grande do Norte, Bahia, Sergipe, Alagoas, and Ceará (Harley 1995, Sousa et al 2004, Rocha 2010, Silva and Palmeira 2014, Fernandes-Ferreira et al. 2015). These enclaves represent an important feature of the heterogeneous Caatinga landscape, which contribute to the maintenance of its biodiversity and regional ecological processes, in particular by providing refuges for many species during the long periods of drought that are typical of the Caatinga (Mares et al. 1981, Ceballos 1995).

The mammals of the cloud forests of northeastern Brazil have been surveyed at a number of sites: Pico do Jabre, in the municipality of Teixeira, and Mata do Pau-Ferro Ecological Station in Areia, both in Paraíba state; Vertentes, Buíque, Serra Negra Biological Reserve in the municipalities of Tacaratu, Floresta and Inajá, respectively, and Vasconcelos Sobrinho State Park, Caruaru, all in Pernambuco state, and Pedra Talhada, on the Pernambuco-Alagoas states border (Sousa et al. 2004). In Alagoas state, Silva and Palmeira (2014) surveyed volant (Emballonuridae, 5 spp.; Phyllostomidae, 12 spp.; Noctilionidae, 1sp.) and nonvolant mammals in the Serra da Mão, in northern Traipu. Fernandes-Ferreira et al. (2015) also surveyed the terrestrial mammals of the Serra do Baturité, in Ceará state. However, porcupines were only recorded in the Ceará state study, where they were represented by the recently described *C. baturitensis* Feijó & Langguth, 2013, considered be endemic to this region (Feijó and Langguth 2013).

Sousa et al. (2004) reported that the genus *Coendou* may be found in well-preserved tracts of cloud forest, but that the cryptic coloration of these animals makes it difficult to locate and collect specimens. It is thus still unclear which species are found in the cloud forests surveyed, due to the uncertain taxonomy of the group. The diagnosis and differentiation of the different porcupine species has nevertheless been facilitated by the recent reviews of Mendes et al. (2013) and Feijó and Langguth (2013).

As *C. prehensilis* is hunted widely for food in the Atlantic Rainforest (Souza and Alves 2014) and its quills are used for zootherapy in the Caatinga region (Souza et al. 2015), it seems likely that *C. speratus* is subject to similar anthropogenic pressures in areas where it occurs in sympathy with *C. prehensilis*, such as in the municipalities of Sirinhaém and Igarassú, in the state of Pernambuco (Feijó and Langguth, 2013). In this case, further research focusing on the potential hunting pressure on the *C. speratus* populations will be necessary for the development of effective measures for the conservation of this species and its habitat.

The high-altitude cloud forest enclaves of northeastern Brazil now only cover 5% of their original area (Lins 1989), but are considered crucial to the understanding of the history of the Atlantic Forest and of the Caatinga and its connections with other forest biomes (Souza et al. 2004). Systematic studies of the diversity and distribution of mammals associated with these enclaves will be especially important in this context, and the erethizontids should be a research priority, especially as recently described species such as *C. speratus* may already be under severe threat.

Acknowledgments

We thank the firefighters of the Pernambuco State Fire Department (1st detachment, 6th Group) in Garanhuns for the rescue of the animal, Dr Diego Astúa de Moraes for receiving of the material collected and incorporating it into the Collection of Mammals of the Federal University of Pernambuco, and Dr Stephen Francis Ferrari of the Federal University of Sergipe for the revision of the English. Two anonymous reviewers provided helpful comments on earlier versions of the manuscript.

Authors' Contributions

WRTJ and RMLN collected the field data and coordinated the research. ESBL identified the specimen. ESBL and FFGS wrote the text.

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